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In re Application of:

WANG et al.

Group Art Unit: 2126

Examiner: Li B. Zhen

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For: ACCELERATING A DISTRIBUTED COMPONENT ARCHITECTURE OVER A NETWORK USING A DIRECT MARSHALING

PENDING CLAIMS AS OF February 27, 2003

1. A method of communication between a first object located on a first computer having a first memory location and a Remote Procedure Call layer, wherein the RPC layer has access to an RPC buffer, and a second object located on a second computer, the first and second computers connected by a network, accessed by the first computer through a network interface card on the first computer, the method comprising: calling an interface of the second object with the first object; placing in the RPC buffer a first pointer to a first parameter, wherein the first parameter is used in the calling of the interface of the second object and wherein the first pointer points to the first parameter in the first memory location; treating, in the RPC layer, the first pointer as a scatter-gather entry; and transmitting, by the network interface card, the first parameter pointed to by the first pointer by reading the first parameter out of the first memory location.

2. The method of claim 1 further comprising issuing a notification on the first computer after the network interface card has finished reading the first parameter out of the first memory location.

3. The method of claim 2 further comprising reclaiming the first memory location after receiving the notification.

4. The method of claim 1 further comprising: placing in the RPC buffer the first pointer to the first parameter and a second pointer to a second parameter, wherein the second parameter is used in the calling of the interface of the second object and wherein the second pointer points to the second parameter in a second memory location on the first computer; treating, in the RPC layer, the second pointer as another scatter-gather entry; and transmitting, by the network interface card, the first parameter pointed to by the first pointer by reading the first parameter out of the first memory location and the second parameter pointed to by the second pointer by reading the second parameter out of the second memory location.

5. The method of claim 4 further comprising issuing a first notification on the first computer after the network interface card has finished reading the first parameter out of the first memory location and issuing a second notification on the first computer after the network interface card has finished reading the second parameter out of the second memory location.

6. The method of claim 5 further comprising reclaiming the first memory location after receiving the first notification.

7. The method of claim 6 further comprising reclaiming the second memory location after receiving the second notification.

8. The method of claim 1 wherein the transmitting comprises: posting, on the first computer, a first send buffer and a first receive buffer prior to sending a first data to the second computer, wherein the first receive buffer will receive a second data from the second computer, and wherein the first receive buffer is posted to be of sufficient size to accept the second data; and sending the first data to the second computer via the first send buffer.

9. The method of claim 8 wherein the transmitting further comprises: cleaning up, on the first computer, a second receive buffer after sending the first data to the second computer and prior to receiving the second data from the second computer.

10. The method of claim 9 wherein the second receive buffer was posted prior to the first receive buffer.

11. The method of claim 8 wherein the transmitting further comprises: cleaning up, on the first computer, a second send buffer after sending the first data to the second computer and prior to receiving the second data from the second computer.

12. The method of claim 11 wherein the send buffer was used to send the first data to the second computer.

13. The method of claim 8 wherein the second data from the second computer is in response to the first data from the first computer.

14. A method of communication between a first object located on a first computer and a second object located on a second computer, the second computer having a memory storage location and a Remote Procedure Call layer, wherein the RPC layer has access to an RPC buffer, the first and second computers connected by a network, accessed by the second computer through a network interface card on the second computer, the method comprising: receiving a call from the first object on an interface of the second object; receiving, by the network interface card, a parameter of the call from the first object; storing, by the RPC layer, the parameter in a memory location; and accessing, by the second object, the parameter.

15. The method of claim 14 wherein the memory location is the RPC buffer.

16. The method of claim 15 wherein the accessing the parameter is performed in the RPC buffer.

17. The method of claim 15 further comprising copying the parameter from the RPC buffer into the memory storage location, wherein the accessing the parameter is performed in the memory storage location.

18. The method of claim 14 wherein the memory location is the memory storage location, and wherein the accessing the parameter is performed in the memory storage location.

19. The method of claim 14 wherein the receiving comprises: storing, on the second computer, a second data into a first receive buffer, wherein the first receive buffer was posted

prior to sending a first data to the first computer, and wherein the first receive buffer was posted to be of sufficient size to accept the second data.

20. The method of claim 19 wherein the first data to the first computer was sent prior to receiving the second data from the first computer.

21. The method of claim 19 wherein the receiving further comprises: cleaning up, on the second computer, a send buffer after sending the first data to the first computer and prior to receiving the second data from the first computer.

22. The method of claim 21 wherein the send buffer was used to send the first data to the first computer.

23. The method of claim 19 wherein the receiving further comprises: cleaning up, on the second computer, a second receive buffer after sending the first data to the first computer and prior to receiving the second data from the first computer.

24. A computer-readable medium having computer-executable instructions for performing steps for communicating between a first object located on a first computer having a first memory location and a Remote Procedure Call layer, wherein the RPC layer has access to an RPC buffer, and a second object located on a second computer, the first and second computers connected by a network, accessed by the first computer through a network interface card on the first computer, the steps comprising: calling an interface of the second object with the first object; placing in the RPC buffer a first pointer to a first parameter, wherein the first parameter is used in the calling of

the interface of the second object and wherein the first pointer points to the first parameter in the first memory location; treating, in the RPC layer, the first pointer as a scatter-gather entry; and transmitting, by the network interface card, the first parameter pointed to by the first pointer by reading the first parameter out of the first memory location.

25. The computer-readable medium of claim 24 having further computer-executable instructions for performing steps comprising: issuing a notification on the first computer after the network interface card has finished reading the first parameter out of the first memory location.

26. The computer-readable medium of claim 25 having further computer-executable instructions for performing steps comprising: reclaiming the first memory location after receiving the notification.

27. The computer-readable medium of claim 24 having further computer-executable instructions for performing steps comprising: placing in the RPC buffer the first pointer to the first parameter and a second pointer to a second parameter, wherein the second parameters is used in the calling of the interface of the second object and wherein the second pointer points to the second parameter in a second memory location on the first computer; treating, in the RPC layer, the second pointer as another scatter-gather entry; and transmitting, by the network interface card, the first parameter pointed to by the first pointer by reading the first parameter out of the first memory location and the second parameter pointed to by the second pointer by reading the second parameter out of the second memory location.

28. The computer-readable medium of claim 27 having further computer-executable instructions for performing steps comprising: issuing a first notification on the first computer after the network interface card has finished reading the first parameter out of the first memory location and issuing a second notification on the first computer after the network interface card has finished reading the second parameter out of the second memory location.

29. The computer-readable medium of claim 28 having further computer-executable instructions for performing steps comprising: reclaiming the first memory location after receiving the first notification.

30. The computer-readable medium of claim 29 having further computer-executable instructions for performing steps comprising: reclaiming the second memory location after receiving the second notification.

31. The computer-readable medium of claim 24 wherein the transmitting comprises: posting, on the first computer, a first send buffer and a first receive buffer prior to sending a first data to the second computer, wherein the first receive buffer will receive a second data from the second computer, and wherein the first receive buffer is posted to be of sufficient size to accept the second data; and sending the first data to the second computer via the first send buffer.

32. The computer-readable medium of claim 31 wherein the transmitting further comprises: cleaning up, on the first computer, a second receive buffer after sending the first data to the second computer and prior to receiving the second data from the second computer.

33. The computer-readable medium of claim 32 wherein the second receive buffer was posted prior to the first receive buffer.

34. The computer-readable medium of claim 31 wherein the transmitting further comprises: cleaning up, on the first computer, a second send buffer after sending the first data to the second computer and prior to receiving the second data from the second computer.

35. The computer-readable medium of claim 34 wherein the send buffer was used to send the first data to the second computer.

36. The computer-readable medium of claim 31 wherein the second data from the second computer is in response to the first data from the first computer.

37. A computer-readable medium having computer-executable instructions for performing steps for communicating between a first object located on a first computer and a second object located on a second computer, the second computer having a memory storage location and a Remote Procedure Call layer, wherein the RPC layer has access to an RPC buffer, the first and second computers connected by a network, accessed by the second computer through a network interface card on the second computer, the steps comprising: receiving a call from the first object on an interface of the second object; receiving, by the network interface card, a parameter of the call from the first object; storing, by the RPC layer, the parameter in a memory location; and accessing, by the second object, the parameter.

38. The computer-readable medium of claim 37 wherein the memory location is the RPC buffer.

39. The computer-readable medium of claim 38 wherein the accessing the parameter is performed in the RPC buffer.

40. The computer-readable medium of claim 38 having further computer-executable instructions for performing steps comprising: copying the parameter from the RPC buffer into the memory storage location, wherein the accessing the parameter is performed in the memory storage location.

41. The computer-readable medium of claim 37 wherein the memory location is the memory storage location, and wherein the accessing the parameter is performed in the memory storage location.

42. The computer-readable medium of claim 37 wherein the receiving comprises: storing, on the second computer, a second data into a first receive buffer, wherein the first receive buffer was posted prior to sending a first data to the first computer, and wherein the first receive buffer was posted to be of sufficient size to accept the second data.

43. The computer-readable medium of claim 42 wherein the first data to the first computer was sent prior to receiving the second data from the first computer.